AMENDED CLAIMS

[received by the International Bureau on 13 October 2004 (13.10.04);
original claim 1 amended, other claims unchanged]

1. A device comprising:

a substrate (16) having first and second generally opposite surfaces, the substrate (16) first surface having a plurality of bond sites (62) disposed thereon;

a die (14) mounted to the first surface of the substrate (16), the die (14) having first and second generally opposite surfaces parallel to the substrate (16) first and second surfaces, the die (14) first surface having a plurality of I/O pads (60) disposed thereon, the I/O pads (60) being electrically connected to the bond sites (62);

a molding compound (18) encapsulating the die (14) and at least the first surface of the substrate (16);

a heat spreader (20) at least partially embedded in the molding compound (18) and having a peripheral cut edge portion (32) aligned with and not recessed from associated peripheral cut edge portions (34, 36) of the substrate (16) and molding compound (18).

2. The device of claim 1, wherein the heat spreader (20) has first and second generally opposite surfaces parallel to the die (14) first and second surfaces, the heat spreader (20) second surface being covered by the molding compound (18) and the heat spreader (20) first surface being uncovered by the molding compound (18).

3. The device of claim 2, wherein the heat spreader (20) is thermally connected to the die by a material (88) having a thermal conductivity higher than a thermal conductivity of the molding compound (18).

4. The device of claim 2, wherein the heat spreader (20) includes a protrusion (100) extending from the heat spreader (20) second surface, the protrusion contacting the die (14).

5. The device of claim 1, wherein the heat spreader (20) includes a down-set leg (52) contacting the substrate (16) first surface.

6. The device of claim 5, wherein the heat spreader (20) is electrically connected to the substrate (16).

7. The device of claim 1, wherein the heat spreader (20) is entirely separated from the substrate (16).

8. The device of claim 1, wherein the heat spreader (20) includes through holes (104) disposed therein for the ingress of the molding compound (18) between the heat spreader (20) and the substrate (16).

9. The device of claim 1, wherein the substrate (16) is a metallic lead frame.

10. The device of claim 1, wherein the substrate (16) comprises a dielectric material (66) having first electrical conductors (72) disposed thereon, the first electrical conductors (72) being selected from at least one of electrically conductive traces, layers, vias, pins, and combinations including one or more of the foregoing.

11. The device of claim 10 further comprising:

an array of second electrical conductors (70) electrically coupling the substrate (16) to an external circuit, the second electrical conductors (70) being selected from at least one of solder balls, solder bumps, solder paste, pins, and combinations including one or more of the foregoing.

12. The device of claim 1, further comprising:

a plurality of wires (64) or conductive tape strips, each being electrically connected between an I/O pad (60) on the die (14) first surface and a bond site (62) on the substrate (16) first surface.

13. The device of claim 1, wherein each of the I/O pads (60) on the die (14) is directly electrically connected to a bond site (62) on the substrate (16) in flip-chip fashion.

14. A method for manufacturing packaged semiconductor devices, the method comprising:

disposing a plurality of dies (14) onto a plurality of interconnected substrates (16);

electrically connecting I/O pads (60) on each die (14) in the plurality of dies to bond sites (62) on an associated substrate (16) in the plurality of interconnected substrates;

securing a plurality of interconnected heat spreaders (20) over the plurality of dies (14);

overmolding the plurality of dies (14), the bond sites (62), and the plurality of interconnected heat spreaders (20) with a continuous coating of molding compound (18) to form a plurality of interconnected package precursors (12); and

singulating the interconnected package precursors (12) to provide a plurality of packages.

15. The method of claim 14, wherein the heat spreader (20) has first and second generally opposite surfaces parallel to the die (14) first and second surfaces, and wherein the overmolding results in the heat spreader (20) second surface being covered by the molding compound (18) and the heat spreader (20) first surface being uncovered by the molding compound (18).

16. The method of claim 15, further comprising:

applying a thermally conductive material (88) to the back of the plurality of dies after the electrically connecting and before the overmolding, the thermally conductive material (88) having a thermal conductivity higher than the thermal conductivity of the molding compound (18).

17. The method of claim 15, wherein the heat spreader (20) includes a protrusion (100) extending from the heat spreader (20) second surface, the protrusion contacting the die (14).

18. The method of claim 14, wherein the plurality of interconnected heat spreaders (20) include a down set portion disposed at a perimeter of the plurality of interconnected heat spreaders, and wherein securing the plurality of interconnected heat

spreaders over the plurality of dies includes disposing the down set portion on the plurality of interconnected substrates, and the singulating includes singulating through the down set portion to provide a package (30) having a heat spreader (20) entirely separated from the substrate (16).

19. The method of claim 14, further comprising:

electrically connecting each heat spreader (20) in the plurality of heat spreaders to an associated substrate (16) in the plurality of substrates.

20. The method of claim 14, wherein the heat spreader (20) includes apertures disposed therein for the ingress of the molding compound (18) between the heat spreader (20) and the substrate (16).

21. The method of claim 14, wherein the substrate (16) is a metallic lead frame.

22. The method of claim 14, wherein the substrate (16) comprises a dielectric material (66) having first electrical conductors (72) disposed thereon, the first electrical conductors (72) being selected from at least one of electrically conductive traces, layers, vias, pins, and combinations including one or more of the foregoing.

23. The method of claim 22, further comprising:

electrically coupling an array of second electrical conductors (70) to the substrate (16), the second electrical conductors (70) being selected from at least one of solder balls, solder bumps, solder paste, pins, and combinations including one or more of the foregoing.

24. The method of claim 14, wherein the electrically connecting the I/O pads (60) to the bond sites (62) includes:

wire bonding or tape bonding the I/O pads (60) to the bond sites (62).

25. The method of claim 14, wherein the electrically connecting the I/O pads (60) to the bond sites (62) includes:

directly electrically connecting the I/O pads (60) to the bond sites (62) in flip-chip fashion.